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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/586,113

**Applicant(s)**

MATSUYAMA, KEISUKE

**Examiner**

STEPHEN A. BRAY

**Art Unit**

2629

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 July 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-63 and 70-72 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-63 and 70-72 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 17 August 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/SB-06)  
Paper No(s)/Mail Date 1/07/2008  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

***Specification***

1. The disclosure is objected to because of the following informalities: Page 18, lines 2-5 of the Applicant's specification discloses the limitation "...as shown in Fig. 19, it is also possible to employ a unit screen 100....". Figure 19 of the Applicant's drawings discloses the structure of a unit screen 90. Therefore the Examiner believes that in the above limitation, the Applicant meant to refer to Fig. 20, instead of Fig. 19. Appropriate correction is required.

***Claim Objections***

2. Claims 2 and 31 are objected to because of the following informalities:

Lines 2-3 of Claim 2 contains the limitation "...the plurality of unit screens include two types of a short unit screen and a long unit screen...". It is unclear to the Examiner whether the Applicant is claiming that there are two types of a short unit screen or if the short unit screen and the long unit screen make up the two types. The Examiner will examine the claim under the assumption that the Applicant is trying to claim that the short unit screen and the long unit screen make up the two types of unit screens.

Lines 2-3 of Claim 31 contains the limitation "...the plurality of unit screens include two types of a short unit screen and a long unit screen...". It is unclear to the Examiner whether the Applicant is claiming that there are two types of a short unit screen or if the short unit screen and the long unit screen make up the two types. The Examiner will examine the claim under the assumption that the Applicant is trying to

claim that the short unit screen and the long unit screen make up the two types of unit screens.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1 and 30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear to the Examiner what the Applicant is trying to claim in Claim 1 with the limitation "...the unit screens of different lengths are disposed to be adjacent to each other...". If the unit screens that are adjacent to a first unit screen in a diagonal direction, as well as a vertical and horizontal direction, are also of a different length, then two unit screens of the same length would be adjacent to each other. The Examiner will examine the claims under the assumption that the Applicant is trying to claim that the unit screens disposed adjacent to each other in the vertical direction and the horizontal direction have different lengths.

It is unclear to the Examiner what the Applicant is trying to claim in Claim 30 with the limitation "...the collective screen has the unit screens of different lengths disposed adjacent to each other...". Again, if the unit screens that are adjacent to a first unit screen in a diagonal direction, as well as a vertical and horizontal direction, are also of a

different length, then two unit screens of the same length would be adjacent to each other. The Examiner will examine the claims under the assumption that the Applicant is trying to claim that the unit screens disposed adjacent to each other in the vertical direction and the horizontal direction have different lengths.

Claims 2-29, 31-63, 70-72 are also rejected as being dependent upon a rejected base claim.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-2, 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Hilsum (US 4,139,261).

**Regarding claim 1,** *Hilsum* discloses a collective screen for a rear projection multi-screen display device comprising a plurality of unit screens having at least two types of lengths in a direction of thickness of the screen, with front end surfaces or optical image output faces thereof joined together flush with each other without any clearance therebetween, wherein the collective screen is provided with a single continuous collective optical image output face, the unit screens of different lengths are disposed to be adjacent to each other, each of the unit screens is provided with a plurality of optical fibers which have the same length within the range of 5 mm to 100

cm and are integrally joined together so that at least front ends and rear ends thereof are aligned substantially in radial contact with each other, and a rear end surface of each of the unit screens constitutes an optical image input face (Figure 3-4 and Column 2, line 63 through Column 3, line 37 of *Hilsum* disclose having odd-numbered panels, i.e. D11, D13, ..., containing fiber optic guide elements which are shorter in length than the fiber optic guide elements of even-number panels, i.e. D12, ..., where the front panel F7 shows that the plurality of display panels D11 – D19 are joined together flush with respect to each other at the front of the display and that the front and rear end of the fiber optic guide elements are in radial contact with each other.).

**Regarding claim 2,** *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein: the plurality of unit screens include two types of a short unit screen and a long unit screen which is longer by at least 1 cm or more than the short unit screen in the direction of thickness of the screen, and the optical image output faces of the short unit screens and the optical image output faces of the long unit screens are disposed in a staggered arrangement on the collective optical image output face (Figure 3-4 and Column 2, line 63 through Column 3, line 37 of *Hilsum* disclose having a plurality of unit screens D11 – D19, where fiber optic guide elements for the odd-number unit screens are shorter in length than the fiber optic guide elements for the even-number unit screens, and where the unit screens are disposed in a staggered arrangement as shown in Figures 3-4.).

**Regarding claim 19,** *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers constituting

the unit screen are formed of either resin or silica (Column 3, lines 63-66 of *Hilsum* discloses having the optical fibers formed from glass, which is silica, or a plastic, which is a resin.).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) in view of *Mannick* (US 6,296,214).

**Regarding claim 3,** *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1.

*Hilsum* fails to teach wherein the optical image input face of the long unit screen is surrounded by a mask member for shielding any leakage light of an optical image out of the optical image input face of the long unit screen, the optical image being projected onto the optical image input face.

*Mannick* discloses wherein the optical image input face of the long unit screen is surrounded by a mask member for shielding any leakage light of an optical image out of the optical image input face of the long unit screen, the optical image being projected onto the optical image input face (Figures 1-4 and Column 5, lines 25-62 of *Mannick*

disclose having the supporting bracket 16 anodized with a black powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Mannick* in order to form a display system in which defective display panels can be more easily replaced by the user.

**Regarding claim 4,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein an antireflective coating is applied to an outer circumferential surface of the long unit screen adjacent to the optical image input face of the short unit screen in a range of at least 5 mm from the optical image input face of the short unit screen towards the rear end thereof (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose that supporting bracket 16 is anodized with a black powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12 and that said supporting bracket 16 extends all the way to the video screen panel 16.).

**Regarding claim 5,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, comprising a support frame for restraining at least an outer circumference of the long unit screen near the optical image input face to support the long unit screen (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose having support structure 18 with a supporting bracket 16 for holding the video screen panels 12.).



**Regarding claim 6**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 5, wherein the support frame is configured to shield any leakage light of an optical image out of the optical image input face of the long unit screen, the optical image being projected onto the optical image input face (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose that supporting bracket 16, which is part of the support structure 18, is anodized with a black powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12 and that said supporting bracket 16 extends all the way to the video screen panel 16.).

9. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) in view of *Nakashima et al* (US 5,206,760).

**Regarding claim 7**, *Hilsum* discloses the collective display screen according to claim 1.

*Hilsum* fails to teach a collective screen support framework for surrounding the single continuous collective optical image output face and securely restraining a front-end outer circumference of the unit screens bundled to constitute the collective optical image output face.

*Nakashima et al* discloses a collective screen support framework for surrounding the single continuous collective optical image output face and securely restraining a front-end outer circumference of the unit screens bundled to constitute the collective

optical image output face (Figures 1-2 of *Nakashima et al* disclose having a support frame 6 which surrounds the unit screens and securely holds them in place.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Nakashima et al* in order to form a display system in which the display panels are securely held in place.

10. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Mannick (US 6,296,214) as applied to claim 6 above, and further in view of Nakashima et al (US 5,206,760).

**Regarding claim 8,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 6.

*Hilsum* as modified above fails to teach a collective screen support framework for surrounding the single continuous collective optical image output face and securely restraining a front-end outer circumference of the unit screens bundled to constitute the collective optical image output face, and the collective screen support framework is provided integrally with the support frame.

a collective screen support framework for surrounding the single continuous collective optical image output face and securely restraining a front-end outer circumference of the unit screens bundled to constitute the collective optical image output face, and the collective screen support framework is provided integrally with the

support frame (Figures 1-2 of *Nakashima et al* disclose having a support frame 6 which surrounds the unit screens and securely holds them in place.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with the teachings of *Nakashima et al* in order to form a display system in which the display panels are securely held in place.

11. Claims 9, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) in view of *Kijima* (US 6,567,594).

**Regarding claim 9**, *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1.

*Hilsum* fails to teach wherein the optical fiber has a quadrangular rear end surface, and the optical image input face of the unit screen is formed in a quadrangular shape with the quadrangular rear end surfaces joined together.

*Kijima* discloses wherein the optical fiber has a quadrangular rear end surface, and the optical image input face of the unit screen is formed in a quadrangular shape with the quadrangular rear end surfaces joined together (Figures 1 and 6B of *Kijima* disclose that it is known in the art to form an optical fiber with a quadrangular rear end surface and a quadrangular front end surface.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made that the fiber optic elements taught by *Kijima* could be

substituted for the fiber optic elements taught by *Hilsum* and would have resulted in a fiber optic panel with quadrangular fiber optic elements.

**Regarding claim 12**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers have a quadrangular front end surface, and these quadrangular front end surfaces are joined together so as to be disposed with the same pitch in vertical and horizontal directions of the screen, thereby forming the optical image output face (Figures 1 and 6B of *Kijima* disclose that it is known in the art to form an optical fiber with a quadrangular rear end surface and a quadrangular front end surface and where the optical fibers are arranged such that they are disposed in the same pitch in the vertical and horizontal directions of the base 20B.).

12. Claims 10-11, 13-16, 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) in view of *Arkas* (US 6,928,219).

**Regarding claim 10**, *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1.

*Hilsum* fails to teach wherein the optical fibers have a regular hexagonal rear end surface and are closely joined together for these regular hexagonal shapes to be formed in a most densely filled arrangement, thereby forming the optical image input face.

*Arkas* discloses wherein the optical fibers have a regular hexagonal rear end surface and are closely joined together for these regular hexagonal shapes to be

formed in a most densely filled arrangement, thereby forming the optical image input face (Figures 1 and 4 of *Arkas* disclose having a plurality of optical fibers with a hexagonal rear end surface joined together into a densely filled array of optical fibers.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made that the fiber optic elements taught by *Arkas* could be substituted for the fiber optic elements taught by *Hilsum* and would have resulted in a fiber optic panel with either circular or hexagonal fiber optic elements.

**Regarding claim 11,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers have a circular rear end surface and are closely joined together for these circular shapes to be formed in a most densely filled arrangement, thereby forming the optical image input face (Figures 2 and 5 of *Arkas* disclose having a plurality of optical fibers with a circular rear end surface joined together into a densely filled array of optical fibers.).

**Regarding claim 13,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers have a regular hexagonal front end surface, and these regular hexagonal front end surfaces are joined together for these regular hexagonal shapes to be formed in a most densely filled arrangement, thereby forming the optical image output face (Figures 1 and 4 of *Arkas* disclose having a plurality of optical fibers with a hexagonal front end surface joined together into a densely filled array of optical fibers.).

**Regarding claim 14,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers have a circular front end surface, and these circular front end surfaces are closely joined together for these circular shapes to be formed in a most densely filled arrangement, thereby forming the optical image output face (Figures 2 and 5 of *Arkas* disclose having a plurality of optical fibers with a circular front end surface joined together into a densely filled array of optical fibers.).

**Regarding claim 15,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, wherein the optical fibers have a circular front end surface, and these circular shapes are joined together so as to be disposed with the same pitch as a diameter of the circular shape in vertical and horizontal directions of the screen, thereby forming the optical image output face (Figures 8A – 8E of *Arkas* disclose having a plurality of optical fibers with a circular front end surface joined together in an array where the circular optical fibers are disposed in the same pitch in the vertical and horizontal directions. Column 6, lines 55-65 of *Arkas* discloses that the optical fibers shown in Figures 8A - 8E are further apart than they would be in practice in order to show the figures in better clarity.).

**Regarding claim 16,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 1, for use in a rear projection multi-screen wherein the optical fiber has a shape of a hollow core pipe (Column 7, lines 41-61 of *Arkas* discloses that it is known to form a plurality of optical fibers where the optical fibers consist of hollow cylinders.).

**Regarding claim 20**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 16, wherein the optical fibers constituting the unit screen are formed of a metal channel member with an inner circumferential surface of a hollow core serving as a reflective face (Figures 25-28 and Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the hollow core of the reflective material serves as a reflective face for the optical fibers that are formed. Column 8, lines 43-49 and Column 9, lines 4-9 of *Arkas* disclose that the sheet of material 250 can be ductile and reflective, which are two properties of a metal.).

**Regarding claim 21**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 20, wherein the metal channel member is formed of a thin metal plate which is bent into a generally rectangular waveform so as to have inner hollow cores and allow the cores to be disposed successively (Figures 25-28 and Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads.).

**Regarding claim 22**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 21, wherein the thin metal plate is corrugated, and a plurality of the thin metal plates are joined together one on another in a direction of thickness so as to close the hollow cores, to constitute the unit screens (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is

known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* discloses laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides.).

**Regarding claim 23**, the collective screen for a rear projection multi-screen display device according to claim 22, wherein the thin metal plate is formed to provide successive quadrangular cross sections, and two of the quadrangular cross sections are opposed to each other to form a quadrangle of a doubled cross-sectional area as a core (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

**Regarding claim 24**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 23, wherein the thin metal plate is formed to have successive trapezoidal cross sections, and two of the trapezoidal cross sections are opposed to each other to form a hexagonal core (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form



optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

**Regarding claim 25,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 21, wherein: the thin metal plate is corrugated; the thin metal plate is connected with a thin right flat reinforcing metal plate to close the quadrangular cross sections and thus form closed quadrangular cross sections disposed successively side by side; and the corrugated thin metal plate and the reinforcing thin metal plate are joined together one on the other in a direction of thickness, thereby forming the unit screens (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

13. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Arkas (US 6,928,219) as applied to claim 16 above, and further in view of Shikata et al (US 6,418,254).

**Regarding claim 17**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 16.

*Hilsum* as modified above fails to teach wherein the front end surface of the optical fiber is coated with a black coating layer.

*Shikata et al* discloses wherein the front end surface of the optical fiber is coated with a black coating layer fiber (Figures 5-7 of *Shikata et al* discloses having a black light absorbing material applied to one side of the unit screen such that only light emitted from the optical fibers is seen by the user.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Shikata et al* in order to form a display system in which crosstalk between adjacent optical fibers can be reduced.

14. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Arkas (US 6,928,219) as applied to claim 16 above, and further in view of Ogawa (US 2002/0089743).

**Regarding claim 18**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 16.

*Hilsum* as modified above fails to teach wherein the rear end surface of the optical fiber is coated with a black coating layer.

*Ogawa* discloses wherein the rear end surface of the optical fiber is coated with a black coating layer fiber (Figure 5-7 of *Ogawa* discloses having a black light absorbing layer 33 applied to the rear surface of the unit screen.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with the teachings of *Ogawa* in order to form a display system in which degraded picture image can be avoided.

15. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) and *Arkas* (US 6,928,219) as applied to claim 21 above, and further in view of *Naum* (US 6,270,244).

**Regarding claim 26,** *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 21.

*Hilsum* as modified above fails to teach wherein the inner circumferential surface of the hollow core of the optical fiber is tapered near an end face of the optical fiber to be increased in inner diameter toward the end face and to form an edge on which the metal channel member has a material thickness of 0.05 mm or less on the end face.

*Naum* discloses wherein the inner circumferential surface of the hollow core of the optical fiber is tapered near an end face of the optical fiber to be increased in inner diameter toward the end face and to form an edge on which the metal channel member

has a material thickness of 0.05 mm or less on the end face (Figures 7A – 7C of *Naum* discloses that it is well known in the art to have the diameter of an optical fiber at the end of the fiber to be larger than the diameter of an optical fiber in the middle of the optical fiber so as to increase the coupling efficient between a light source, i.e. projector or display, and the optical fiber. Figures 13-14 of *Arkas* disclose that it is also known to make the diameter of the other end of the optical fiber larger than the diameter of the middle of the optical fiber in order to output a larger amount of light.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with the teachings of *Naum* in order to form a display system in which a more efficient coupling between the display image source and the optical fiber can be achieved.

16. Claims 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) in view of Shikata et al (US 6,418,254).

**Regarding claim 27**, *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1.

*Hilsum* fails to teach wherein an outer circumferential surface of an end portion of the optical fiber is coated with a black coating layer in a range of at least 3 mm from the end face of the optical fiber.

*Shikata et al* discloses wherein an outer circumferential surface of an end portion of the optical fiber is coated with a black coating layer in a range of at least 3 mm from the end face of the optical fiber (Figures 5-7 and Column 5, lines 18-28 of *Shikata et al*

discloses having said optical fiber coated with a black-colored light-absorbing adhesive 306.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Shikata et al* in order to form a display system in which crosstalk between adjacent optical fibers can be reduced.

**Regarding claim 28**, *Hilsum* as modified above discloses the collective screen for a rear projection multi-screen display device according to claim 27, for use in a rear projection multi-screen wherein the black coating layer which coats the outer circumferential surface of the end portion of the optical fiber is formed of an adhesive for securely adhering the end portion of the optical fiber in a direction of a diameter thereof (Figures 5-7 and Column 5, lines 18-28 of *Shikata et al* discloses having said optical fiber coated with a black-colored light-absorbing adhesive 306.).

17. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) in view of *Ota et al* (US 6,819,861).

**Regarding claim 29**, *Hilsum* discloses the collective screen for a rear projection multi-screen display device according to claim 1.

*Hilsum* fails to teach wherein the rear end surface or the optical image input face of the unit screen is concave spherical.

*Ota et al* discloses wherein the rear end surface or the optical image input face of the unit screen is concave spherical (Figure 11(A) and Column 15, lines 60-67 of *Ota et*

al discloses that it is known in the art to provide an optical waveguide with a concave curved surface where light is to enter the waveguide.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Ota et al* in order to form a display system in which the light collection efficiency of the input end of the display screen is enhanced.

18. Claim 30-35, 43, 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) in view of Mannick (US 6,296,214).

**Regarding claim 30**, *Hilsum* discloses a rear projection multi-screen display device, comprising:

a collective screen for serving as a single continuous collective optical image output face, the collective screen having front end surfaces or optical image output faces of a plurality of unit screens being collectively joined together flush with each other without any clearance therebetween, the plurality of unit screens having at least two types of lengths in a direction of thickness of the screen (Figure 3-4 and Column 2, line 63 through Column 3, line 37 of *Hilsum* disclose having odd-numbered panels, i.e. D11, D13, ..., containing fiber optic guide elements which are shorter in length than the fiber optic guide elements of even-number panels, i.e. D12, ..., where the front panel F7 shows that the plurality of display panels D11 – D19 are joined together flush with respect to each other at the front of the display and that the front and rear end of the fiber optic guide elements are in radial contact with each other.); and

the collective screen has the unit screens of different lengths disposed adjacent to each other (Figures 3-4 of *Hilsum* discloses that odd displays D11, D13, ... are disposed adjacent to even displays D12, D14, ..., and that the odd displays and the even displays have different lengths.), and

each of the unit screens is provided with a plurality of optical fibers which have the same length in a range of 5 mm to 100 cm and are integrally joined together so that at least front ends and rear ends thereof are aligned substantially in radial contact with each other (Figure 3 of *Hilsum* discloses each unit screen having a plurality of optical fibers, where the front ends and rear ends of the optical fibers are aligned and the optical fibers are the same length.).

*Hilsum* fails to teach having projectors which are the same in number as the unit screens and disposed behind the collective screen corresponding respectively to the unit screens, the projector projecting an optical image onto a rear end surface or an optical image input face of the corresponding unit screen.

*Mannick* discloses having projectors which are the same in number as the unit screens and disposed behind the collective screen corresponding respectively to the unit screens, the projector projecting an optical image onto a rear end surface or an optical image input face of the corresponding unit screen (Figure 1 of *Mannick* discloses having a plurality of projectors which are the same in number as the number of screens 12, where the projectors project an image onto the back of the corresponding unit screen 12.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Mannick* in order to form a display system in which defective display panels or image projectors can be more easily replaced by the user.

**Regarding claim 31**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein: the plurality of unit screens include two types of a short unit screen and a long unit screen which is longer by at least 1 cm or more than the short unit screen in the direction of thickness of the screen, and the optical image output faces of the short unit screens and the optical image output faces of the long unit screens are disposed in a staggered arrangement on the collective optical image output face (Figure 3-4 and Column 2, line 63 through Column 3, line 37 of *Hilsum* disclose having a plurality of unit screens D11 – D19, where fiber optic guide elements for the odd-number unit screens are shorter in length than the fiber optic guide elements for the even-number unit screens, and where the unit screens are disposed in a staggered arrangement as shown in Figures 3-4.).

**Regarding claim 32**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical image input face of the long unit screen is surrounded by a mask member for shielding any leakage light of an optical image out of the optical image input face of the long unit screen, the optical image being projected onto the optical image input face (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose having the supporting bracket 16 anodized with a black



powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12.).

**Regarding claim 33,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein an antireflective coating is applied to an outer circumferential surface of the long unit screen adjacent to the optical image input face of the short unit screen in a range of at least 5 mm from the optical image input face of the short unit screen towards the rear end thereof (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose that supporting bracket 16 is anodized with a black powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12 and that said supporting bracket 16 extends all the way to the video screen panel 16.).

**Regarding claim 34,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, comprising a support frame for restraining at least an outer circumference of the long unit screen near the optical image input face to support the long unit screen (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose having support structure 18 with a supporting bracket 16 for holding the video screen panels 12.).

**Regarding claim 35,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 34, wherein the support frame is configured to protrude toward the projector with respect to the optical image input face of the long unit screen and to shield any leakage light of a projected optical image out of the optical image input face (Figures 1-4 and Column 5, lines 25-62 of *Mannick* disclose

that supporting bracket 16, which is part of the support structure 18, is anodized with a black powder coating in order to prevent any light from the projectors from leaking into an adjacent video screen 12 and that said supporting bracket 16 extends all the way to the video screen panel 16.).

**Regarding claim 43, *Hilsum*** as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the projector is designed to project a beam of light quadrangular in cross section while scanning across the optical image input face (Figure 1A of *Mannick* discloses that the beam of light emitted by the projector is designed such that the size of the beam of light fits the size of the screen 12 that the light is being projected onto. Therefore if the screen 12 is quadrangular in shape, then the beam of light outputted from the projector would be quadrangular in shape.).

**Regarding claim 53, *Hilsum*** as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fibers constituting the unit screen are formed of either resin or silica (Column 3, lines 63-66 of *Hilsum* discloses having the optical fibers formed from glass, which is silica, or a plastic, which is a resin.).

19. Claims 36, 38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) and *Mannick* (US 6,296,214) as applied to claims 30 and 34 above, and further in view of *Nakashima et al* (US 5,206,760).

**Regarding claim 36**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 34.

*Hilsum* as modified above fails to teach wherein a Fresnel lens is attached to each of the support frames associated with the respective unit screens between the projector and the optical image input face of the unit screen associated therewith, the Fresnel lens slightly diverging or generally collimating an optical image projected from the projector.

*Nakashima et al* discloses a Fresnel lens is attached to each of the support frames associated with the respective unit screens between the projector and the optical image input face of the unit screen associated therewith, the Fresnel lens slightly diverging or generally collimating an optical image projected from the projector (Figure 1 of *Nakashima et al* disclose having a Fresnel lens 2a and 2b disposed between projectors and display screens 1a and 1b.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with the teachings of *Nakashima et al* in order to form a display system in which the display panels are securely held in place and the joints that are visible between the plurality of projection units are smaller.

**Regarding claim 38**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein a Fresnel lens is provided to each of the unit screens between the projector and the optical image input face of the unit screen associated therewith, the Fresnel lens slightly diverging or collimating an

optical image diverged when projected from the projector (Figure 1 of *Nakashima et al* disclose having a Fresnel lens 2a and 2b disposed between projectors and display screens 1a and 1b.).

**Regarding claim 39**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, comprising a collective screen support framework for surrounding and securing an outer circumference of the unit screens integrated into one piece to constitute the collective optical image output face (Figures 1-2 of *Nakashima et al* disclose having a support frame 6 which surrounds the unit screens and securely holds them in place.).

**Regarding claim 40**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 34, wherein a collective screen support framework for surrounding and securing an outer circumference of the unit screens integrated into one piece to constitute the collective optical image output face (Figures 1-2 of *Nakashima et al* disclose having a support frame 6 which surrounds the unit screens and securely holds them in place.).

20. Claims 37 and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) and *Mannick* (US 6,296,214) as applied to claim 30 above, and further in view of *Ota et al* (US 6,819,861).

**Regarding claim 37**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30.

*Hilsum* as modified above fails to teach wherein the optical image input face of the unit screen is concave spherical, and a center of optical image emission of the projector is disposed near a center of the concave spherical surface.

*Ota et al* discloses wherein the optical image input face of the unit screen is concave spherical, and a center of optical image emission of the projector is disposed near a center of the concave spherical surface spherical (Figure 11(A) and Column 15, lines 60-67 of *Ota et al* discloses that it is known in the art to provide an optical waveguide with a concave curved surface where light is to enter the waveguide. Figure 1a of *Mannick* discloses that the center of optical emission for the projector is centered on the center of the corresponding screen 12.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Ota et al* in order to form a display system in which the light collection efficiency of the input end of the display screen is enhanced.

**Regarding claim 63,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the rear end surface or the optical image input face of the unit screen is concave spherical (Figure 11(A) and Column 15, lines 60-67 of *Ota et al* discloses that it is known in the art to provide an optical waveguide with a concave curved surface where light is to enter the waveguide.).

21. Claims 41-42, 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Mannick (US 6,296,214) as applied to claim 30 above, and further in view of Kijima (US 6,567,594).

**Regarding claim 41**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30.

*Hilsum* as modified above fails to teach wherein the optical fiber has a quadrangular rear end surface, and the optical image input face of the unit screen is formed in a quadrangular shape with the quadrangular rear end surfaces joined together.

wherein the optical fiber has a quadrangular rear end surface, and the optical image input face of the unit screen is formed in a quadrangular shape with the quadrangular rear end surfaces joined together (Figures 1 and 6B of *Kijima* disclose that it is known in the art to form an optical fiber with a quadrangular rear end surface and a quadrangular front end surface.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made that the fiber optic elements taught by *Kijima* could be substituted for the fiber optic elements taught by *Hilsum* and would have resulted in a fiber optic panel with quadrangular fiber optic elements.

**Regarding claim 42**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 41, wherein the optical fiber has a regular quadrangular rear end surface (Figures 1 and 6B of *Kijima* disclose that it is known in

the art to form an optical fiber with a quadrangular rear end surface and a quadrangular front end surface.).

**Regarding claim 46**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 40, wherein the optical fibers have a quadrangular front end surface, and these quadrangular front end surfaces are joined together so as to be disposed with the same pitch in vertical and horizontal directions of the screen, thereby forming the optical image output face (Figures 1 and 6B of *Kijima* disclose that it is known in the art to form an optical fiber with a quadrangular rear end surface and a quadrangular front end surface and where the optical fibers are arranged such that they are disposed in the same pitch in the vertical and horizontal directions of the base 20B.).

22. Claims 44-45, 47-50, 54-59, 70-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) and *Mannick* (US 6,296,214) as applied to claim 30 above, and further in view of *Arkas* (US 6,928,219).

**Regarding claim 44**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30.

*Hilsum* as modified above fails to teach wherein the optical fibers have a hexagonal rear end surface and are closely joined together for these hexagonal shapes to be formed in a most densely filled arrangement, thereby forming the optical image input face.

*Arkas* discloses wherein the optical fibers have a hexagonal rear end surface and are closely joined together for these hexagonal shapes to be formed in a most densely filled arrangement, thereby forming the optical image input face (Figures 1 and 4 of *Arkas* disclose having a plurality of optical fibers with a hexagonal rear end surface joined together into a densely filled array of optical fibers.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made that the fiber optic elements taught by *Arkas* could be substituted for the fiber optic elements taught by *Hilsum* and would have resulted in a fiber optic panel with either circular or hexagonal fiber optic elements.

**Regarding claim 45,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fibers have a circular rear end surface and are closely joined together for these circular shapes to be formed in a most densely filled arrangement, thereby forming the optical image input face (Figures 2 and 5 of *Arkas* disclose having a plurality of optical fibers with a circular rear end surface joined together into a densely filled array of optical fibers.).

**Regarding claim 47,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fibers have a regular hexagonal front end surface, and these regular hexagonal front end surfaces are joined together for these regular hexagonal shapes to be formed in a most densely filled arrangement, thereby forming the optical image output face (Figures 1 and 4 of *Arkas* disclose having a plurality of optical fibers with a hexagonal front end surface joined together into a densely filled array of optical fibers.).



**Regarding claim 48,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fibers have a circular front end surface, and these circular front end surfaces are closely joined together for these circular shapes to be formed in a most densely filled arrangement, thereby forming the optical image output face (Figures 2 and 5 of *Arkas* disclose having a plurality of optical fibers with a circular front end surface joined together into a densely filled array of optical fibers.).

**Regarding claim 49,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fibers have a circular front end surface, and these circular shapes are joined together so as to be disposed with the same pitch in vertical and horizontal directions of the screen, thereby forming the optical image output face (Figures 8A – 8E of *Arkas* disclose having a plurality of optical fibers with a circular front end surface joined together in an array where the circular optical fibers are disposed in the same pitch in the vertical and horizontal directions. Column 6, lines 55-65 of *Arkas* discloses that the optical fibers shown in Figures 8A - 8E are further apart than they would be in practice in order to show the figures in better clarity.).

**Regarding claim 50,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, for use in a rear projection multi-screen wherein the optical fiber has a shape of a hollow core pipe (Column 7, lines 41-61 of *Arkas* discloses that it is known to form a plurality of optical fibers where the optical fibers consist of hollow cylinders.).

**Regarding claim 54,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 50, wherein the optical fibers constituting the unit screen are formed of a metal channel member with an inner circumferential surface of a hollow core serving as a reflective face (Figures 25-28 and Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the hollow core of the reflective material serves as a reflective face for the optical fibers that are formed. Column 8, lines 43-49 and Column 9, lines 4-9 of *Arkas* disclose that the sheet of material 250 can be ductile and reflective, which are two properties of a metal.).

**Regarding claim 55,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 54, wherein the metal channel is formed of a thin metal plate which is bent into a rectangular waveform so that quadrangular cross sections with an inner hollow core are successively formed (Figures 25-28 and Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads.).

**Regarding claim 56,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 54, wherein the thin metal plate is corrugated, and a plurality of the thin metal plates are joined together one on another in a direction of thickness so as to close the hollow cores, to constitute the unit screens (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the

art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* discloses laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides.).

**Regarding claim 57, *Hilsum*** as modified above discloses the rear projection multi-screen display device according to claim 55, wherein the thin metal plate is formed to provide successive quadrangular cross sections, and two of the quadrangular cross sections are opposed to each other to form a quadrangle of a doubled cross-sectional area as a core (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

**Regarding claim 58, *Hilsum*** as modified above discloses the rear projection multi-screen display device according to claim 57, wherein the thin metal plate is formed to have successive trapezoidal cross sections, and two of the trapezoidal cross sections are opposed to each other to form a hexagonal core (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using

a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads.

Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

**Regarding claim 59**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 54, wherein: the thin metal plate is corrugated; the thin metal plate is connected with a thin right flat reinforcing metal plate to close the quadrangular cross sections and thus form closed quadrangular cross sections disposed successively side by side; and the corrugated thin metal plate and the reinforcing thin metal plate are joined together one on the other in a direction of thickness, thereby forming the unit screens (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

**Regarding claim 70**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein a plurality of the optical

fibers for a collective screen are disposed side by side to be integrally formed in a shape of a belt (Figures 25-28 and Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of the corrugations formed can be altered by changing the shape of the working heads.).

**Regarding claim 71**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30, wherein the optical fiber comprising a thin metal plate which is bent into a quadrangular waveform so that quadrangular cross sections are successively formed, wherein a plurality of hollow optical fibers with each of the quadrangular cross sections having a hollow core are disposed side by side and integrally formed in a shape of a belt screens (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads. Column 8, lines 43-49 and Column 9, lines 4-9 of *Arkas* disclose that the sheet of material 250 can be ductile and reflective, which are two properties of a metal.).

**Regarding claim 72**, *Hilsum* as modified above discloses the rear projection multi- screen display device according to claim 71, wherein the thin metal plate is

corrugated to be connectable one on another in a direction of thickness so as to close the hollow core (Column 8, lines 17 through Column 9, line 23 of *Arkas* disclose that it is known in the art to form optical fibers using a sheet of material 250, where the sheet of material 250 is corrugated and the shape of corrugations formed can be altered by changing the shape of the working heads. Figures 25-28 and Column 8, line 62 through Column 9, line 16 of *Arkas* disclose laying the corrugated sheets on top of each other to form an array of channels which act as hollow waveguides, and then welded or glued together to hold the desired waveguide shape. Column 8, lines 37-42 of *Arkas* discloses that the shape of the corrugation can be changed by using differently shaped working heads.).

23. Claims 51 rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Mannick (US 6,296,214) and *Arkas* (US 6,928,219) as applied to claim 50 above, and further in view of *Shikata et al* (US 6,418,254).

**Regarding claim 51**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 50.

*Hilsum* as modified above fails to teach wherein the front end surface of the optical fiber is coated with a black coating layer.

*Shikata et al* discloses wherein the front end surface of the optical fiber is coated with a black coating layer (Figures 5-7 of *Shikata et al* discloses having a black light absorbing material applied to one side of the unit screen such that only light emitted from the optical fibers is seen by the user.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Shikata et al* in order to form a display system in which crosstalk between adjacent optical fibers can be reduced.

24. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Mannick (US 6,296,214) and Arkas (US 6,928,219) as applied to claim 50 above, and further in view of Ogawa (US 2002/0089743).

**Regarding claim 52,** *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 50.

*Hilsum* as modified above fails to teach wherein the rear end surface of the optical fiber is coated with a black coating layer.

*Ogawa* discloses wherein the rear end surface of the optical fiber is coated with a black coating layer (Figure 5-7 of *Ogawa* discloses having a black light absorbing layer 33 applied to the rear surface of the unit screen.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with the teachings of *Ogawa* in order to form a display system in which degraded picture image can be avoided.

25. Claim 60 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilsum (US 4,139,261) and Mannick (US 6,296,214) and Arkas (US 6,928,219) as applied to claim 54 above, and further in view of Naum (US 6,270,244).

**Regarding claim 60**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 54.

*Hilsum* as modified above fails to teach wherein the inner circumferential surface of the hollow core of the optical fiber is tapered near an end face of the optical fiber to be increased in inner diameter toward the end face and to form an edge on which the metal channel member has a material thickness of 0.05 mm or less on the end face.

*Naum* discloses wherein the inner circumferential surface of the hollow core of the optical fiber is tapered near an end face of the optical fiber to be increased in inner diameter toward the end face and to form an edge on which the metal channel member has a material thickness of 0.05 mm or less on the end face (Figures 7A – 7C of *Naum* discloses that it is well known in the art to have the diameter of an optical fiber at the end of the fiber to be larger than the diameter of an optical fiber in the middle of the optical fiber so as to increase the coupling efficient between a light source, i.e. projector or display, and the optical fiber. Figures 13-14 of *Arkas* disclose that it is also known to make the diameter of the other end of the optical fiber larger than the diameter of the middle of the optical fiber in order to output a larger amount of light.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to further modify the display system taught by *Hilsum* with



the teachings of *Naum* in order to form a display system in which a more efficient coupling between the display image source and the optical fiber can be achieved.

26. Claims 61-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Hilsum* (US 4,139,261) and *Mannick* (US 6,296,214) as applied to claim 30 above, and further in view of *Shikata et al* (US 6,418,254).

**Regarding claim 61**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 30.

*Hilsum* as modified above fails to teach wherein an outer circumferential surface of an end portion of the optical fiber is coated with a black coating layer in a range of at least 3 mm from the end face of the optical fiber.

*Shikata et al* discloses wherein an outer circumferential surface of an end portion of the optical fiber is coated with a black coating layer in a range of at least 3 mm from the end face of the optical fiber (Figures 5-7 and Column 5, lines 18-28 of *Shikata et al* discloses having said optical fiber coated with a black-colored light-absorbing adhesive 306.).

Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the display system taught by *Hilsum* with the teachings of *Shikata et al* in order to form a display system in which crosstalk between adjacent optical fibers can be reduced.

**Regarding claim 62**, *Hilsum* as modified above discloses the rear projection multi-screen display device according to claim 61, wherein the black coating layer which

coats the front-end outer circumferential surface of the optical fiber is formed of an adhesive for securely adhering the front end portion of the optical fiber in a direction of a diameter thereof (Figures 5-7 and Column 5, lines 18-28 of *Shikata et al* discloses having said optical fiber coated with a black-colored light-absorbing adhesive 306.).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN A. BRAY whose telephone number is (571)270-7124. The examiner can normally be reached on Monday - Friday, 9:00 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, AMR AWAD can be reached on (571)272-7764. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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22 May 2010